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SOL - A NEARLY TRIPLE SYSTEM

While conventional wisdom credits our solar system with one sun and at least 9 planets, there is some justification for changing this to three suns and 7 planets. The two largest 'planets', Jupiter and Saturn, both radiate more energy than they receive from the sun. For Jupiter the excess is 1.9 times larger but for Saturn it is an impressive 2.6 times.

In the Earth's case, the balance between incoming and outgoing radiation is virtually exact, with only a tiny excess due to heat produced by the decay of radioactive elements in the crust. But Jupiter and Saturn are weak infrared 'stars' and can be treated as such when calculations are developed to show their early evolution.

Ground-based and Pioneer space probe observations indicate that the chemical composition of the solar system giants is more star-like than planetary, consisting mainly of hydrogen, helium and light elements. Now the question is being asked 'did these planets evolve like stars?' J.B. Pollack of NASA goes so far as to place the planets on the Hertzsprung-Russell diagram, the traditional evolutionary chart for stars.

There are several clues from the present behaviour of Jupiter and Saturn that can justify a star-like history. These are the internal heat and excess radiation of the two bodies, the properties of their satellite systems, and the present masses and radii of the two.

Radioactive decay of unstable elements is not sufficient to account for the infrared emission of the two planets. Several solutions have been proposed for Jupiter, but most can be rejected says Pollack, except for that related to gravity. The gravitational effect--which is the energy-generating mechanism of very young stars--could come in three varieties. Jupiter could be contracting now, it could be heated from a reservoir of past contraction, or it could be due to a fall in internal temperature which makes helium immiscible in hydrogen, so that the two separate, generating heat (just as oil and water will not remain mixed, but gradually separate.)

The satellite systems of the two giants also evoke some curiosity. Jupiter's collection of moons (now 14) looks very much like a miniature solar system. The density of the Galilean satellites, from inner Io, to outer Callisto, falls off in a regular manner. The densities of Ganymede and Callisto are so low that they would seem to have a large proportion of water ice. Theorists of the solar system argue that the decrease in planetary densities is due to the decreasing temperature of the nebula from which the planets condensed. The lighter and more volatile elements could only form into planetary bodies at large distances from the early sun, where temperatures were lower. Perhaps Jupiter's moons did much the same.

Saturn, however, is not so well behaved. Its inner moons have a low density and considerable water ice. Titan has considerable methane as well, and the rings appear to be chips of ice.

The third clue is the composition of Jupiter and Saturn. Both are very similar to the sun and one is led to speculate that they can be treated like low mass stars. The basic history of such a star is that it collapses gravitationally, heating up until the various cycles of nuclear reactions can begin. As the star enters the main sequence, it stops contracting and settles down for a prolonged stay.

When Jupiter is treated by such a fashion, a model results which resembles the actual composition quite closely, at least as far as we know it. On the Hertzsprung-Russell diagram, Jupiter behaves like a pre-main sequence star in its early life, and like a white dwarf in its current life. However, Jupiter never manages to stay on the main sequence, since it doesn't get hot enough to begin hydrogen burning. The planet finally reaches a stage of electron degeneracy, in which it refuses to contract further. Thus the present excess radiation seems to come from a reservoir generated by past contraction.

Saturn tends to evolve faster than Jupiter in the model, generating less heat. However, being colder, the immiscibility of hydrogen and helium may have much to do with its heat. The fact that Saturn does not fit its present state quite so neatly at the end of its evolution, may mean that it has a rocky core.

Because Jupiter evolved slowly, and emitted more heat, it may have been able to control the evolution of its inner planets to a large extent. Saturn evolved so quickly that it never generated enough heat to excercise control. At the time it was cold enough for water ice to form, the moisture was inside Roche's limit and was unable to coalesce into a solid body, forming the rings instead.

So there seems to be a hierarchy of development in both the larger planets and the sun--a hierarchy which justifies consideration of Jupiter and Saturn as meager stars.

-Jay Anderson

The Crab Nebula pulsar, NP0532, suffered a third glitch, or sudden speed up of pulse rate, on February 4. These glitches are attributed to starquakes in the crust of a neutron star. The quakes allow the crust of the pulsar to settle slightly, thus increasing its roatation rate. A similar speed-up of rotat' n occurs when a figure skater pulls in her arms while doing a spin.

A CALENDAR OF MANNED SPACEFLIGHT

from Vostok to Skylab

SKYLAB 2 - July 28 to September 25, 1973

The second crew was commanded by Captain Alan Bean, who walked on the moon during the voyage of Apollo 12. Dr. Owen Garriott was the science pilot, with Major Jack Lousma as pilot. Their craft was like a miniature Space-age Ark, with temporary residence of two minnows and fifty eggs, six mice, 720 fruit fly pupae, and two common cross spiders nicknamed Arabella and Anita. On July 28 they thundered up from the Cape and smoothly entered earth orbit. During the eight hour chase of Skylab, a thruster unit on the CSM sprung a leak. Bean switched it off and successfully docked with the lab. Soon the men were bustling around inside the station, turning on lights, fans, and air conditioners. But as they continued to work the entire crew could feel the symptoms of motion sickness coming on. It wasn't long before all three astronauts fell behing in their work schedules and needed time to adjust to the effects of weightlessness. Due to a short circuit in the environmental controls for the fruit fly pupae and pocket mice, their two space colonies expired. By the fifth day, the crew's condition improved and the men looked forward to starting the main body of their work.

Early the next morning Garriott and Lousma discovered that a second set of thrusters on the CSM had sprung a leak. That left the capsule with only two of its four set operable, jeopardizing its ability to ferry the crew home. The failure of the units could be an indication that the rest would soon go. NASA placed the Kennedy Space Centre on an emergency schedule to prepare for a rescue mission.

With no other thrusters failing, the crew began intensive studies of the earth's natural resources. A 6,000 mile sweep surveyed a Pacific storm, cropland in Colorado, an oil-rich area of Oklahoma, and resources in Louisiana; measured sea roughness in the Gulf of Mexico; and charted rivers in the Amazon Basin.

On August 6th Garriott and Lousma suited up for a spacewalk to spread a new sunshade over the rumpled original, and to replenish solar telescope film. After they had spread the awning, temperatures began dropping even more in the workshop. On this same day, Arabella, the astrospider, tried her first web in zero gravity. Garriott reported: "She's got very unusual webs spun around all corners of the box, with some of the stringers even from corner to corner." So she had to do a lot of improving. Checking the next day, he noted that she had spun a completely new web overnight: "she's a very fast learner indeed," because this web was like one you would find on earth.

Medical tests every three days revealed that the men's bodies were slowly changing, but not as quickly as the previous crew's.

Doctors surmised that the second team was benefiting from the advice of the first: take more exercise--at least an hour a day. In the first week of September the sun suddenly exploded with awesome fury. Thirty-one flares erupted in one day. "It looks like somebody's been kicking the heck out of it," reported Lousma. Festering active regions, dotted by sunspots and wreathed with looping filaments, filled the solar disc. Towering loops of gases changed in ways never before recorded. A huge flare in the northern hemishpere was followed by one in the southern--perhaps eruptive material crossed the sun's equator. Week's end brought the greatest flare of all--"It's the big daddy!" exclaimed Bean.

Doctors monitoring the crew's health found another phenomenon: Forty days into the flight, the gradual change in the astronauts' physiological responses appeared to halt. It meant that they had reached a plateau, and established man's capabilities for flights of almost indefinite duration.

After 59 days in orbit, the crew temporarily shut down the lab again, and entered the space capsule. Bean undocked from the lab, and to safeguard the sunshade from thruster damage, he abandoned the fly-around inspection of the lab. Following special re-entry instructions from the ground (due to two faulty thrusters) he guided the ship home safely. The capsule splashed down off San Diego on September 25, only 2.8 miles off target. Aboard the recovery ship USS New Orleans, doctors found that "in some tests the men look better than the first Skylab crew," an improvement attributed to their exercise. Their achievements exceeded all expectations. They made 39 earth surveys, spent 305 hour at telescopes capturing an astonishing 71,700 photographs of the sun in all of its violent moods, and flew around the world 858 time on a voyage of 24.5 million miles.

SOYUZ 12--On September 27, 1973, Soviet officials announced the successful placement of a manned spacecraft into orbit around the earth. The two cosmonauts aboard Soyuz remained aloft for two days after launch from the Central Asian Space Centre. The 45 year old commander, Vasily Lazarev, was accompanied by Oleg Markarov, a 40 year old civilian from near Moscow. Launched at 15:18 Moscow time on the 27th, Soyuz 12 achieved an orbit with apogee and perigee heights of 231 and 202 kilometers, respectively, and inclined 51.5 degrees to the earth's equator. Using both manual and automatic controls, the cosmonauts maneuvered their spacecraft into a somewhat higher orbit that ranged between 345 and 326 kilometers. The men began a series of tests and started taking spectrograms of the earth's surface to be used for economics research. Two days later Lazarev and Makarov returned safely. This completed the first Soviet manned flight since the ill-fated Soyuz 11 mission in June, 1971.

--Don Hladiuk

APRIL MEETING

The monthly meeting of RASC (Winnipeg) will take place on April 9th at 8:00 pm in Room 110, Lockhart Hall, at the University of Winnipeg. Two slide shows will be presented: the first compiled by Don Hladiuk on the recent Soviet Space exhibit in Winnipeg and on Skylab; the second given by Roy Belfield on the process of building his observatory. It is hoped active discussion will ensue from the latter with respect to the club's upcoming construction of an observatory building at Glenlea. Your attendance and opinion will be welcomed.

UPCOMING : Dr. R. Bochonko in May, Mr. Ed Barker on UFO's in June.

MINUTES

The first meeting of March, on the 12th, had 3 distinct topics. Paul Moffat thouroughly dealt with surfacing a mirror with Aluminum vs. silver, with regard to durability, reflectance, and expense. He also exhibited his 3" refractor and its newly-made cartop wooden mount, complete with slowmotion controls. He then described computation of aperature and exposure equivalences for 2 telescopes of different aperatures and speeds.

In a topical subject, Bill Krosney discussed the possibility of viewing Comet West using articles and tables for academically finding it. Visual and photographic descriptions were given of observations made to that date.

The President announced procurement of an observatory site at Glenlea.

The second meeting, of the 19th, heard Dr. Tom Bolton of the University of Toronto give a fine discussion of X-ray astronomy entitled "The Universe through Superman's Eyes". Though the location was makeshift, the talk presented preliminary results in one of the newer fields of astronomy. Almost all bases were covered: binary stars, nova, radiation from clusters of galaxies, and black holes. Included in the large array of slides shown was a spectacular jewel of Centaurus A, taken by one of the DDO astronomers. Dr. Bolton stressed the work of Canadian astronomers in his discussion, infusing a new respect for some of the work of our countrymen. Considerable discussion followed the talk before several slides were shown of Comet West.

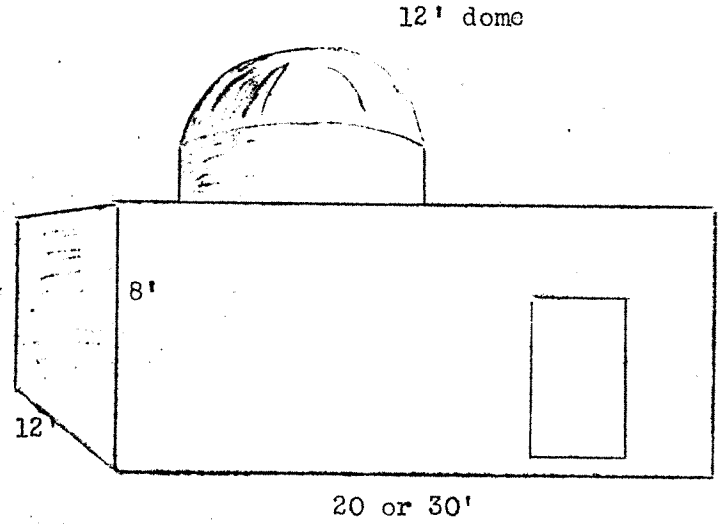
--Ella Dack

FOR SALE: UNITRON Model 142C 3-inch refracting telescope. Specifications include equitorial mount with clock drive and slow-motion controls, UNIHEX with 6 eyepieces plus barlow lens, solar projection assemble, and piggyback camera mount. Two years old, in very good condition. Original cost $730 (including customs duty). Make an offer. Contact: Mitch Tulloch
916 Byng Place,
453-6193

THE OBSERVATORY PROJECT

With the announcement that the University of Manitoba has donated a piece of property to the Centre for building a small observatory, planning has now entered an active stage. The site is at their Glenlea Experimental Station, about 15 miles south of St. Norbert. Surrounding the site are fields of wheat and rice, with a pig and cow barn about ½ mile north. Immediately to the east is the Red River, but flooding is not expected to be a problem.

Tentative plans for the building are based on the model depicted below. Discussion is now concentrating on such items as overall size, construction costs, interior layout and eventual use.



At a meeting at the President's house on Sunday March 28, the observatory committee tried to come to grips with the details. According to an estimate from Paul Moffat, the cost of an appropriate 12' x 20' cement pad would be approximately $400. This pad would be 12" thick laid over 6" of gravel with steel reinforcing, and all the labour would be supplied by the club. To have this pad built for us, costs would escalate to between $650 and $800 according to Roy Belfield, with no labour to be supplied. Since the bulk of the labour would comein digging the hole, the cost of renting a front end loader to do this will be investigated. However, Frank Richardson pointed out that the pouring of the concrete could be a problem since the amount involved is considerable, and there is little experience in the club for this facet of construction.

To build the walls of cinder block will require just over $1000, not including the roof. To do the same in wood, including the roof and the cement base, would cost about $750 to $850 provided all labour was supplied by the centre. On top of this will be the proce of the pier, but little discussion of this aspect ensued because no decision could be made on its necessary size. According to Frank Richardson, it is possible to dig a 32" wide hole to a depth of 12' by hand, given a reasonable supply of muscle.

The dome design is fairly straightforward, and will be similar to that at Roy Belfield's house, but scaled upward to 12'. Cost was extravagantly estimated at $600.

Total cost of a wooden structure, thus becomes about $1500 to $2000 if all work is done by the centre. The consensus of the committee wasthat no more than $2500 should be spent on the structure.

Considerable discussion ensued as to whether the building should be enlarged to 12' x 30', thus providing room to utilize it for more than nightime observing. While no final decision was reached, all members were in favor of pouring a pad of at least 12'x 30' so that some expansion or use of supplementary piers on the site could ensue at a future date.

The members of the centre should realize that their services will be required in June for the start of this project. Should you wish to make some suggestions for the building, there are numberous executive members who can be contacted.

--Judy Anderson

LIBRARY NEWS

"The Universe and Dr. Einstein" by Lincoln Barnett is a brilliant attempt to bring the theories of Einstein to the non-scientific reader. Dr. Einstein spent the last years of his life working on his Unified Field Theory. Through his work a new perception of the universe emerged; one which is far removed from the world perceived and bounded by the five senses. The first part of the book deals with the fundamental building blocks; atoms, electrons, etc; the middle chapters explain the various theories of other great scientists; the last part is an interesting discussion of the possible structure of the universe as a whole and what may be looked for in Einstein's field theory.

Contribution: "Today and Tomorrow and.." by Asimov (anonymous donation)

Acquisitions: "The New Outline of Science" by David Dietz
"Jupiter" by Asimov

Quotation: "We are both spectators and actors in the great drama of existence." Niels Bohr

Question: "Read any good books lately?"--Phyllis Belfield

SOUTHERN TELESCOPES

Australia, despite its size, has a number of problems, including dust storms, lack of high mountains, and monsoon-like rains, which limit the number of sites for large telescopes. However the new Anglo - Australian 3.9 meter telescope at Siding Spring seems to have found a suitable home, and has come up with some new discoveries to inaugurate its working life.

The first involves the BL Lacertid objects, which were long regarded as peculiar stars. A few years back, a closer look showed them to resemble quasars, and some astronomers attempted to classify them between quasars and compact galaxies. They would then be similar to the enigmatic Seyfert galaxies.

One problem with this idea was that no distance estimates could be made for BL Lacterae objects, because their very bright nuclei showed no spectral lines. No redshift could then be measured. However a few of the members of this group have faint halos in which there is hope of finding spectral lines, providing the halos can be distinguished from the overpowering brightness of the nuclei.

Australian astronomers have managed to photograph absorption lines using a new photoelectronic device which enhances faint objects. A redshift of .07 has been calculated for PKS 0548-322 yielding a distance of 350 megaparsecs. This would give it approximately the luminosity of a bright elliptical galaxy. Some problems remain as it appears to be a member of a cluster whose redshirt is only $\frac{1}{2}$ that of the BL Lacertid.

The two Magellenic Clouds are now one of the most fertile areas of research for southern astronomers, especially concerning the astrophysics of galaxies. Using a radio receiver sensitive to 2.6 millimeter radiation, a group from the University of London was able to convert the Siding Spring instrument into a radio telescope. The wavelength they measured is that due to carbon monoxide, a gas which is closely associated with regions od star formation. It has been found in other external galaxies, but its presence in the Large Magellenic Cloud will allow its distribution and behaviour to be studied in some detail. Because carbon monoxide is an organic compound, its presence leads to speculation about life forms. The discovery, in the Magellenic Clouds, of more of the three dozen known galactic molecules will add fuel to theories combining interstellar chemistry and planetary chemistry.

ASTROPHOTOGRAPHY

The very name astrophotography sometimes scares off the beginner who tends to think that it requires large instruments, clock drives and so on. This is not so.

Almost any camera can be used to take shots of the sky, as many found out photographing Comet West last month. Using a normal (50 mm) lense on a tripod mounted camera, you can capture earth-

shine, conjunctions with planets, and various stages of a lunar eclipse. Using the same set-up, one can photograph comets, aurora, and constellations, reaching to the ninth magnitude even with short exposures of 15 to 20 seconds. If one has a telephoto lens such as a 135mm so much the better, again provided the exposure is kept short.

Results obtained by using the equipment mentioned above on Comet West were remarkable! It can be done, so try it.

--Roy Belfield

NEWS NOTES

Potassium has been found mixed in with the sodium and hydrogen clouds which surround Jupiter's satellite Io. The potassium cloud seems to originate in the same manner as the sodium -- by "sputtering" from the surface of the moon when hit by charged particles from Jupiter.

The world's largest optical telescope, 237 inches across, is now in operation in the USSR. The telescope is located at 6800' in the Caucasus Mountains. Though it took its first photograph at the end of the last year, regular observations commenced on February 7. The first undertaking of this giant telescope will be a study of quasars.

At the beginning of April, Comet West is still visible to the naked eye. After its discovery on Nov 5/75, original predictions placed it at fifth magnitude, and secondary estimates ranged around first magnitude in December's "Comet News" bulletin. Some reports had it seen on Feb. 25 running about 2 magnitudes brighter than forecast, and after perihelion it was estimated between -1.5 and -3. By all accounts its recent appearance was one of the most brilliant and exciting astronomical 'happenings' for quite some time.

The tail was photographed as a pair of dust tails, and it first appeared with "synchronic bands" sweeping off in an Aurora-like curtain effect. Bill Krosney's photograph captured these striations beautifully. Visually the tail fanned out over a 35° wedge and extended 30° northerly--corresponding to 42,000,000 miles. A photo through the Belfields' Schmidt cameraand various lovely pictures have developed from 50-200mm lenses piggybacked on driven telescopes. Colour and infrared photographs by Jay Anderson show distinctly the two halves of the tail although through the Celestron, no distinguishable divisions in the head appeared, as recounted in April's Sky and Telescope. Dr. Scatliff's photos showed a possible anti-tail but no further evidence of that phenomenon has surfaced.

A display board of Comet West photographs is being assembled by the club for the convention in Calgary, so don't be bashful about contributing prints or negatives for duplication. Such a magnificent comet can stand the limelight!

--Judy Anderson